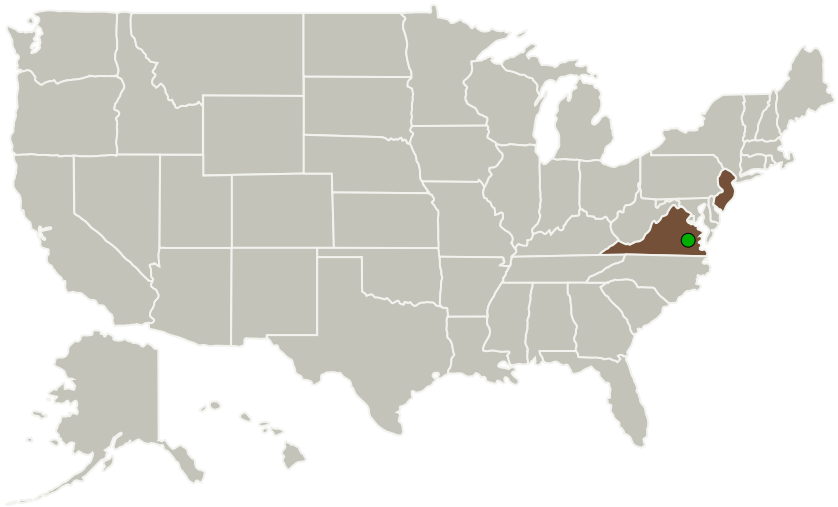
Self-healing FRCs: A New Approach to Damage Tolerant Cryotanks, Phase I

Completed Technology Project (2014 - 2014)

Project Introduction

Composite cryotanks, or Composite Overwrapped Pressure Vessels (COPVs), offer advantages over currently used aluminum-lithium cryotanks, particularly with respect to weight savings. Future NASA missions are expected to use COPVs in spaceflight propellant tanks to store fuels, oxidizers, and other liquids for launch and space exploration vehicles. However, reliability and reusability of the COPVs are of concern, especially in cryogenic temperature applications; this limits adoption of COPVs in future reusable vehicle designs. The major problem with composites is the inherent brittleness of the epoxy matrix, which is prone to microcrack formation, either from exposure to cryogenic conditions or from impact from different sources. If not prevented, the microcracks can grow into larger cracks, leading to catastrophic failure and loss of function of the composite. Accordingly, materials innovations are needed to mitigate, as well as self-heal, microcrack damage in composite cryotanks. In Phase I we propose to demonstrate microcrack prevention and mitigation in composite test panels through the use of a novel nanocomposite matrix containing engineered nanoscale materials which will also enable self-healing of microcracks. Phase II will build upon the Phase I program in order to optimize the material design and to characterize the long-term durability of the scaled-up composite test panels.

Primary U.S. Work Locations and Key Partners



Self-healing FRCs: A New Approach to Damage Tolerant Cryotanks Project Image

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Organizations Performing Work	Role	Type	Location
NEI Corporation	Lead Organization	Industry Small Disadvantaged Business (SDB)	Piscataway, New Jersey
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
New Jersey	Virginia

Project Transitions

June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137512)*

Images

Project Image
Self-healing FRCs: A New Approach to Damage Tolerant Cryotanks Project Image
(https://techport.nasa.gov/image/129946)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
NEI Corporation

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

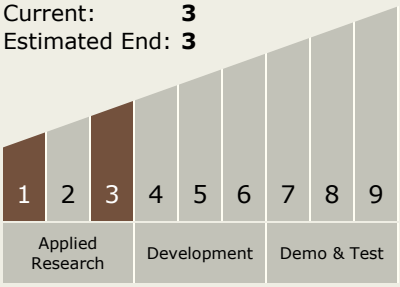
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Daniel E Eberly

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.1 Lightweight Structural Materials

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System